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Research article

# Green investment and dividend payouts: An intercontinental perspective

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A B S T R A C T

In this research paper, we conduct an examination of the impact of green investments on dividend policies within both polluting and environmentally friendly firms. Utilizing two distinct model assumptions, we analyze a global sample of firms from 21 countries spanning the period from 2013 to 2022 to derive our primary empirical findings and perform robustness tests. Our analysis incorporates two estimation techniques: Ordinary Least Squares (OLS) and System-GMM (Generalized Method of Moments). Our findings reveal that green investment policies have a positive influence on environmentally friendly companies while exerting a detrimental effect on the dividend distributions of polluting companies. This influence is statistically and economically significant. Furthermore, our results remain consistent when employing alternative tests based on agency costs, other stakeholders and before and during Covid-19. On the other hand, when we used system-GMM method, our results also showed that green investment policies have a positive influence on environmentally friendly companies while exerting a detrimental effect on the dividend distributions of polluting companies.

## 1. Introduction

Academics and industry professionals have dedicated significant attention to the challenges of sustainability and climate change. Policymakers have focused on increasing financial support for sustainable projects and enhancing financial intermediation. International agreements, such as the United Nations Environment Programme Finance Initiative, the Equator Principles, and the International Finance Corporation Sustainability Framework, have urged banks to consider environmental factors when granting credit. Despite the substantial progress made in green business over the past decade, there remains uncertainty regarding whether energy-intensive and polluting firms adjust their financial practices in response to investor sentiment compared to environmentally friendly and non-energy firms (Li et al., 2023).

Specifically, it is unclear whether green investments are favored by investors as a means to enhance their reputation and wealth or if adopting a green investment approach leads to subpar financial performance (Li et al., 2023). However, the financial performance of green investments worldwide remains ambiguous. According to conventional dividend theory, businesses utilize dividends to signal their potential for future profitability (Bhattacharya, 1979; Hasan, 2021a, 2022; Miller and Rock, 1985). Dividend payments indicate their commitment to reducing agency related conflicts (La Porta et al., 2000; Jensen, 1986). Dividends reduce free cash flow and discourage managerial opportunistic actions, making them a critical tool for shareholder protection (Easterbrook, 1984; Jensen and Meckling, 1976). In nations with ineffective legal protections, where the minority of shareholders have few alternatives, a company's reputation for treating shareholders fairly holds great value. Consequently, the need to utilize dividends to build a strong reputation is highest in these nations, and dividend distribution serves as a proxy for shareholder protection (La Porta et al., 2000). Companies often increase dividend payments to appease shareholders before adverse news related to employee litigation becomes public (Unsal and Brodmann, 2019).

In this study, we examine the impact of green investments on dividend policy in both polluting and environmentally friendly firms. We hypothesize that companies operating in heavily polluted regions will be incentivized to take deliberate measures to counteract the negative perception arising from nearby air pollution, even if they are not the primary polluters. Our fundamental assumption regarding dividend

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policy is that companies in more polluted regions have more likelihood to invest less in green initiatives while increasing dividend payments compared to firms that invest more in sustainability and maintain lower dividend payouts. Additionally, we propose that in contexts with significant knowledge asymmetry, the negative relationship between investment in green energy companies and dividend distribution is more pronounced. This is because, in situations with information asymmetry, individuals are likely to depend on 'crude' indicators and mental shortcuts (Campbell et al., 2016). Accordingly, companies operating in polluted regions and those with greater information asymmetry-problems might be motivated to issue dividends to demonstrate their success, attract potential investors, and offset the adverse effects of local air pollution. Furthermore, we argue that, since dividend payments effectively address agency issues, companies may employ dividend distributions as an impression management strategy, particularly when agency problems are substantial (Easterbrook, 1984; Hasan, 2021b; Hasan and Islam, 2022; Jensen, 1986; La Porta et al., 2000).

We cannot rule out an alternative hypothesis suggesting that a negative investment shock may not necessarily lead to higher dividend payouts. Additionally, according to signalling theory, dividend payments serve as a reliable signal of a company's promising future (Hasan, 2021a, 2022). To convey a positive message to stakeholders, companies may maintain or even increase their dividend distribution levels. This argument may be particularly relevant in our context, as the adoption of green investments may concern stakeholders who are worried about the future prospects of polluting firms. Consequently, when green investments decrease due to sustainability policies, polluting corporations may be hesitant to reduce dividend payouts in order to maintain favorable market perceptions.

In this research, we employ impression management techniques, which are referred to as anticipatory impression management or impression offsetting techniques. It is well-known that a positive reputation provides companies with a competitive advantage in the marketplace. Hence, impression management is an important strategy employed by managers to meet stakeholders' expectations and establish a strong reputation (Chintagunta and Chu, 2021; Lanzolla and Frankort, 2016). However, there is limited research on how businesses handle unfavorable perceptions of their local environment.

The impact of green investments on dividend payments by polluting companies (greenery companies) remains an unanswered empirical question. Our study uses data from 21 countries spanning the period from 2013 to 2022 and employs relevant empirical techniques, including OLS and system GMM. Our findings demonstrate that green investment policies have a favorable impact on green companies while exerting a detrimental effect on the dividend distributions of polluting companies. This impact is both statistically and economically significant. Our results remain robust when subjected to alternative tests.

Our paper offers noteworthy contributions to several key domains within the existing literature. Firstly, it distinguishes itself as the first major paper to employ impression management techniques in probing the intricate nexus between green investments and dividend payouts. Secondly, our research undertakes a comprehensive examination of the intricate interplay among three central variables greenness, the extent of green investment, and dividend payouts. Lastly, our study embarks on a rigorous inquiry into the influence of corporate governance on shaping the relationship between environmental considerations, green investment strategies, and dividend distribution. Thus, our contribution highlights promising directions for research, emphasizing methodological rigor and the examination of multifaceted relationships in sustainable finance.

The remainder of our paper is organized as follows: Section 2 provides the theoretical discussions and develops relevant hypotheses. Section 3 introduces the empirical framework and explains our dataset. Section 4 engages in a critical discussion of the empirical findings, and in Section 5, we conclude the paper.

## 2. Literature review and hypotheses development

### 2.1. Concept and definition of green investment

In light of the conspicuous absence of a universally ratified definition, the imperative task of elucidating the concept of 'green investment' is set forth herein. To address this, it is necessary to establish a clear and precise conceptualization. As elucidated by Eyraud et al. (2013), 'green investments' are characterized as financial allocations expressly directed towards the abatement of greenhouse gas emissions and the curbing of air pollutants. This delineation is aligned with terms such as 'environmental protection investments' and 'ecological investments.'

The corpus of extant scholarly discourse, exemplified by the contributions of Doval and Negulescu (2014), Martin and Moser (2012), and Murillo-Luna et al. (2008), among other scholars, converges on a central idea: 'green investment' manifests as an overarching commitment to augment a firm's capital allocation in line with environmental governance practices. This commitment aligns with contemporary corporate social responsibility initiatives, signifying a conscientious integration of ecological stewardship into the operational ethos of organisations. Notably, 'green management' and 'corporate environmentalism' are conceptually intertwined with 'green investing,' collectively advancing the discourse on sustainable business practices.

Ateş et al. (2012) assert the indispensability of internal investments in promoting green production, logistics, and design. This perspective injects substantive depth into our comprehension of 'green investment,' reveals its complexity and alignment with broader sustainability imperatives. Furthermore, Voica et al. (2015) add a key dimension by including corporate low-carbon investments and climate adaptation initiatives under the scope of 'green investments.' These encompass a diverse array of sectors, including clean technology, renewable energy, and climate change mitigation. This comprehensive perspective contrasts with a more circumscribed definition that primarily addresses pollution management within the scope of 'environmental protection investments.' Instead, it proffers a holistic view that acknowledges the intricate interplay of societal, economic, and environmental determinants.

While the definitional landscape surrounding 'green investment' exhibits clear disparities across the academic context, it is promising to observe substantial convergences across the disciplines, commodities, technologies, services, and processes encompassed within these delineations, as highlighted by Inderst et al. (2012). This convergence reinforces our research pursuits, providing a robust foundational platform.

### 2.2. Impression management

In the context of corporate reputation management, it is well-established that companies face reputational risks when they fail to meet stakeholder expectations (Fombrun, 1996; George et al., 2016). To mitigate such risks and enhance stakeholders' perceptions, businesses often employ impression management as a strategic imperative. Responsive impression management involves providing justifications or additional information in response to a negative event that has impacted consumers' perceptions of the company (Bolino et al., 2008). This approach aims to reduce the adverse effects of such focal events. However, it is important to note that stakeholders may also perceive these responses as self-serving or defensive, potentially exacerbating the negative impact (Wang et al., 2016). Hence, previous studies recommend that companies implement proactive measures to shape external stakeholders' perceptions, either in anticipation of or during a negative event (outcome) (Elsbach, 2012; Elsbach et al., 1998).

Anticipatory impression management encompasses various strategies, including *'strategic noise'* and the *'big bath'* approach. Strategic noise strategies involve disseminating positive and negative information irrelevant to impending adverse events. This method aims to divert attention and dilute the focus on the event itself (Graffin et al., 2011). Conversely, the *'big bath'* strategy entails announcing further adverse news either in advance of or concurrently with major event/s. This approach is based on the idea that when circumstances are already bad, the impact of additional negative news is seen as marginal. Moreover, the 'big bath' strategy allows companies to set lower financial targets for the future, making them easier to meet (Graffin et al., 2016). Expanding the repertoire of anticipatory impression management, Graffin et al. (2016) introduce the concept of 'impression offsetting.' This strategy involves proactively releasing unrelated positive news before an impending adverse event. By doing so, companies aim to elicit favorable stakeholder perceptions, prevent the formation of negative impressions, or at the very least, offset the adverse consequences of the focal event.

### 2.3. Theoretical development

In the contemporary competitive landscape, businesses are compelled to give siginifcanrt attention to environmental considerations (Franco et al., 2020). At the same time, corporations are progressively adopting environmentally conscious practices, not only to strengthen relationships with existing customers but also to appeal to a broader consumer base. This broader demographic includes environmentally conscious consumers who place significant importance when making their purchasing determinations (Peattie, 2001). These discerning consumers, aside from being conscientious buyers, wield substantial influence as autonomous opinion leaders within the contemporary marketplace context (Truffer et al., 2017). As posited by Ambec and Lanoie (2008) and Buysse and Verbeke (2003), the incorporation of environmental stewardship within corporate mandates aligns harmoniously with societal expectations, particularly the burgeoning demand for organisations to take a principled stance on social and ethical issues. Such strategic alignments have the potential to significantly augment an organization's standing and reputation, consequently attracting consumer patronage and driving favorable impacts on their financial performance.

Nevertheless, is an existed a protracted debate regarding the causal nexus between green manufacturing practices and commercial success. Porter and van der Linde (1995) assert that green practices can indeed catalyse enhanced financial performance for a company. These practices not only enable an enterprise to distinguish itself from competitors by positioning itself as an 'environmentally friendly' entity but also bolster its reputation in an era marked by heightened environmental consciousness. In their bid to foster more substantive stakeholder engagements, businesses have adopted the practice of transparently communicating their green manufacturing endeavours (Groening et al., 2018; Olsen et al., 2014). This transparency, in turn, inclines consumers toward favouring such firms, leading to increase purchases (Lin et al., 2013; Molina-Azorín et al., 2009; Rivera, 2002), thereby contributing to improved financial performance. However, it is important to acknowledge that the adoption of green practices may potentially exert adverse effects on an organization's financial performance, as they may conflict with other operational objectives (González-Benito and González-Benito, 2005) and pose implementation challenges (Menguc and Ozanne, 2005).

In light of these considerations, the theoretical underpinning of this research is based on 'the self-determination theory' (Deci and Ryan, 2000; Ryan and Deci, 2000), which illuminates the motivating forces that drive consumers toward aligning with societal goals, particularly those pertaining to environmental stewardship. This framework aligns with prior research on individual responsibility (Cappa et al., 2019, 2020; Koo and Chung, 2014), highlighting the intrinsic nature of individuals as 'active, growth-oriented organisms' inclined toward the integration of disparate facets of self and societal structures (Deci and Ryan, 2000). In their search of psychological nourishment, essential for their psychological development and integrity, consumers gravitate toward products offered by environmentally conscientious entities (Ryan and Deci, 2000). This consumption behaviour creats self-satisfaction, ultimately contributing to the financial robustness of firms engaged in green manufacturing. Consequently, the evaluation of products within the marketplace emerges as an influential determinant, as consumers meticulously weigh a product's environmental impact alongside other considerations prior to purchase (Truffer et al., 2017).

### 2.4. Hypothesis development

Within the domain of environmental economics, significant attention has been devoted to investment challenges, particularly in the context of green investments, given their key role in reducing traditional energy usage and alleviating the escalating pollution crisis. Drawing from the findings of previous studies (such as Zhang et al., 2016; Eyraud et al., 2013), it is detected that several factors favor green investment, including economic development, low interest rates, elevated fuel costs, and stringent environmental regulations. Furthermore, Liao and Shi (2018) have emphasized that the enforcement of robust environmental regulations can incentivize businesses to allocate financial resources toward the development and adoption of green technologies.

However, the existing body of literature concerning green investment remains relatively limited. Green investment policies focused on the debt capital market are important for climate change (Li et al., 2021; Boubaker et al., 2024). These policies not only impact the mobilization related to private capital of clean energy development but also enhance the cost competitiveness of projects aimed at reducing pollution (Heine et al., 2019). The influence of green related investments is profound, significantly contributing to the establishment of effective energy systems and resilient climate markets. These, in turn, play a key role in minimizing emissions related to pollution and advancing sustainability goals (Heine et al., 2019; Krushelnytska, 2019; Lindenberg, 2014). Increased investments in green technology, coupled with the transition from non-renewable to renewable energy sources, improve production efficiency in businesses and mitigate the adverse environmental consequences associated with their operational activities (Antonietti and Marzucchi, 2013; Eyraud et al., 2013).

Empirical findings suggest that reducing greenhouse gas emissions may have short-term adverse effects on GDP growth and employment (Weyant, 1993; Liu et al., 2018; Maji, 2015), often requiring capital expenditures. However, in the long run, environmental policies may stimulate economic growth. For instance, Sweden, an early adopter of a carbon tax scheme in 1991 and currently having the highest carbon tax rate worldwide, has consistently achieved GDP growth rates exceeding the European mean - value (World Bank, 2016; Frank, 2018). These findings, along with others (Lu et al., 2010), support the *Porter hypothesis* (Porter and van der Linde, 1995; Porter, 1991), which posits that businesses frequently innovate or adapt their technologies to explore alternative production methods, thereby reducing CO2 emissions without causing lasting harm to GDP and employment. Based on this, we formulate the following hypotheses.

**H1a**. Firms in polluted areas invest less to become greenery and pay more dividends.

**H1b**. Firms in greenery areas invest more to become greenery to keep greenery and pay low amount of dividend.

Furthermore, we posit that in situations characterized by substantial knowledge asymmetry, the inverse association between dividend payments and LG becomes more evident. This is based on the premise that under conditions of asymmetric information, individuals tend to rely on empirical signals and employ mental shortcuts as means of coping with information disparities (Campbell et al., 2016). Consequently,

**Table 1**
Variable definition
Table 1 presents the definitions of all variables used in the analysis. The sample period is 2013–2022.

| Variable name | Variable definition | Source |
|---|---|---|
| *DIV_dum* | A dummy variable and equals 1 if a firm pays cash dividends in year t and 0 otherwise. | Eikon database and author calculation |
| *DPS* | Dividend (cash) per share measured in Dollar. | Eikon database and author calculation |
| *Payout_ratio* | Dividend payout ratio, computed as DPS/earnings per share (EPS). | Eikon database and author calculation |
| *Greenness* | C2O, a measure of greenness of a firm's headquarters location. | Eikon database and author calculation |
| *Green_investment* | Percentage of turnover invested per year to be more resource efficient. | Eikon database and author calculation |
| *Ind/Board* | Ratio of the number of independent board members to the total number of board members. | Eikon database and author calculation |
| Ln*(Board)* | Logarithm of 1 + the number of board members. | Eikon database and author calculation |
| *Size* | Natural logarithm of firm's market capitalization. | Eikon database and author calculation |
| *Leverage* | Total debt divided by total assets. | Eikon database and author calculation |
| *ROE (Return on Equity)* | Firm's earnings performance (Net yearly income divided by the value of its equity). | Eikon database and author calculation |
| *Cash/TA* | Ratio of cash and cash equivalent to total assets. | Eikon database and author calculation |
| *Growth_sale* | Sales growth rate in year t. | Eikon database and author calculation |
| Ln*(Assets)* | Logarithm of total assets. | Eikon database and author calculation |
| *Volatility* | It is the standard deviation of returns based on the past 12 months of monthly returns (Monthly return of underlying stock). | Eikon database and author calculation |
| *Shock* | It takes value one if it falls in 2020–2022(Covid−19); otherwise, 0. | Eikon database and author calculation |

enterprises situated in environmentally compromised areas and regions characterized by heightened information asymmetry are incentivized to allocate resources toward dividend payments. Such actions serve the dual purpose of signalling their financial robustness to potential investors and mitigating the adverse repercussions of localized air pollution.

We also contend that dividend payouts, serving as an effective mechanism for reducing agency conflicts (as suggested by: Easterbrook, 1984; Jensen, 1986; La Porta et al., 2000), assume heightened significance in instances where the agency problem becomes more server. Based on the above rationale, we posit the following hypothesis.

**H2.** If green investment is increase (decrease) as a result of the green investment policy, polluting corporations may be unwilling to higher (lower) dividend payouts.

## 3. Sample selection and research design

### 3.1. Description of sample

The study employs a dataset spanning from 2013 to 2022, as detailed in Table 1. The dependent variable encompasses dividend payout, which is measured through three distinct metrics: (1) a binary 'dividend dummy' variable; (2) actual 'dividend payout'; and (3) the 'dividend payout ratio.' Greenness represents our primary independent variable, serving as a proxy for stakeholders' environmental concerns. It is quantified as the inverse of the carbon dioxide ($CO_2$) emissions of a firm's headquarters city. A higher greenness value signifies a lower level

**Table 2**
Index name by country
Table 2 reports all the index names by country used in this research paper. The paper has used 21 indexes from 21 different countries. The sample period is 2013–2022.

| No. | Country name | Index |
|---|---|---|
| 1 | Australia | S&P_ASX−200 |
| 2 | Belgium | BEL−20 |
| 3 | Bulgaria | BES SOFIX |
| 4 | Canada | S&P_TSX Composite |
| 5 | Croatia | CROBEX |
| 6 | Denmark | OMX Copenhagen−20 |
| 7 | Finland | OMX Helsinki−25 |
| 8 | France | CAC 40 |
| 9 | Germany | DAX |
| 10 | Hungary | BUX |
| 11 | Italy | FTSE MIB |
| 12 | Japan | Nikkei 225 |
| 13 | Netherlands | AEX |
| 14 | New Zealand | NZX 50 |
| 14 | Norway | OSE All Share |
| 16 | Poland | WIG 30 |
| 17 | Spain | IBEX 35 |
| 18 | Sweden | OMX Stockholm 30 |
| 19 | Switzerland | SMI |
| 20 | United Kingdom | FTSE−100 |
| 21 | United States of America | S&P−500 |

**Table 3**
Firm's number by year
Table 3 present the firm's number by year. The sample period is 2013–2022.

| Year | Freq. | Percentage | Cum. |
|---|---|---|---|
| 2013 | 12 | 0.17 | 0.17 |
| 2014 | 270 | 3.82 | 3.99 |
| 2015 | 636 | 9.00 | 12.99 |
| 2016 | 707 | 10.00 | 22.99 |
| 2017 | 834 | 11.80 | 34.79 |
| 2018 | 881 | 12.46 | 47.26 |
| 2019 | 973 | 13.77 | 61.02 |
| 2020 | 1032 | 14.60 | 75.62 |
| 2021 | 1059 | 14.98 | 90.61 |
| 2022 | 664 | 9.39 | 100.00 |
| Total | 7068 | 100.00 | |

of environmental concern among stakeholders. Our second independent variable is 'green investment,' quantified as the percentage of annual turnover allocated toward resource-efficient initiatives. The third independent variable includes 'corporate governance metrics,' denoted as 'governance,' and includes indicators such as 'Ind/Board' and 'Ln (Board).'

As for control variables, 'firm size' constitutes the initial control variable, determined as the natural logarithm of a firm's market capitalization, in alignment with the methodologies employed byHasan et al. (2023) and Das et al. (2023). It is a widely acknowledged premise that larger corporations often exhibit superior performance relative to their smaller counterparts, which can be attributed to their diverse skills, including operational efficiency and the ability to achieve economies of scale and scope. (Majumdar, 1997; Penrose, 1995). Consequently, an evident association is anticipated between firm size and dividend policy, in concordance with the insights of Hasan et al. (2024). 'Leverage' is another control variable, as elevated debt levels, as posited by Lazar (2016), can cause agency problems and underinvestment concerns (Ibhagui and Olokoyo, 2018). Table 1 lists the remaining conventional control variables.

Overall, our dataset includes 21 countries, comprising sixteen European nations, two North American states, one Asian nation, and two

**Table 4**
Descriptive statistics
Table 4 characterizes the descriptive statistics. The statistics reported are the number of observations in our sample, the mean of the data series, and the standard deviation of the data series. The sample period is 2013–2022.

| Variables | Obs. | Mean | Std. dev. | Mini. | Max. | Q1 | Median | Q3 |
|---|---|---|---|---|---|---|---|---|
| *DIV_dum* | 7068 | 0.879 | 0.325 | 0 | 1 | 1.000 | 1.000 | 1.000 |
| *DPS* | 7068 | 0.637 | 0.223 | 0.400 | 0.880 | 0.400 | 0.619 | 0.880 |
| *Payout_ratio* | 7068 | 15.408 | 4.013 | 11.159 | 19.791 | 11.159 | 14.945 | 19.791 |
| *Greenness* | 7068 | 0.123 | 0.073 | 0.048 | 0.204 | 0.048 | 0.106 | 0.204 |
| *Green_investment* | 7068 | 0.162 | 0.509 | 0 | 1.800 | 0 | 0 | 0 |
| *Ind/Board* | 7068 | 0.684 | 0.238 | 0 | 1 | 0.538 | 0.750 | 0.889 |
| Ln*(Board)* | 7068 | 2.350 | 0.271 | 1.386 | 4.585 | 2.197 | 2.397 | 2.485 |
| *Size* | 7068 | 9.516 | 0.315 | 9.181 | 9.858 | 9.181 | 9.491 | 9.858 |
| *Leverage* | 7068 | 0.272 | 0.175 | 0 | 2.439 | 0.152 | 0.257 | 0.375 |
| *ROE (Return on Equity)* | 7068 | 0.006 | 0.075 | −1.118 | 3.455 | 0.002 | 0.003 | 0.006 |
| *Cash/TA* | 7068 | 0.088 | 0.087 | 0 | 0.783 | 0.027 | 0.064 | 0.119 |
| *Growth_sale* | 7068 | 0.019 | 0.019 | 0 | 0.041 | 0 | 0.009 | 0.041 |
| Ln*(Assets)* | 7068 | 9.617 | 0.338 | 9.252 | 9.979 | 9.252 | 9.647 | 9.989 |
| *Volatility* | 7068 | 0.021 | 0.018 | 0 | 0.241 | 0.011 | 0.017 | 0.026 |
| *Shock* | 7068 | 0.146 | 0.353 | 0 | 1 | 0 | 0 | 0 |

Australian territories (please see Table 2 for a detailed breakdown of countries). The countries index, detailing the specific sources from which our data was thoroughly collated, is reported in Table 2.

Table 3 provides insights into the distribution of firms across various years. In our dataset, we have assembled a total of 7068 individual observations. Notably, Table 3 presents the year-wise distribution of these observations. Evidently, year 2021 emerges with the highest count of observations, totalling 1,059, followed by the year 2020, which records the second-highest number of observations at 1032. However, the year 2013 stands out with the lowest count of observations, tallying merely 12.

### 3.2. Research design

We use four individual model specifications to examine whether and how green investment influence dividend policy, in both polluting and environmentally friendly firms. Our method is defined as follows:

*Determinants of* greenness *and green investment*: We use the following panel regression model in Equation (1) to establish the determinants of greenness and green investment following Bolton and Kacperczyk (2021):

$$\left(Greenness\ (Green_{\ investment})_{i,t} = \alpha_0 + \alpha_1 (Controls)_{i,t} + \sum \varphi_1 Year_I + \sum \varphi_2 Industry_I + \xi_{i,t}\right. \tag{1}$$

where, $Greenness_{i,t}$ is our first independent variable, this proxy uses for stakeholders' environmental concerns, established by the inverse of C2O emission of a company's headquarters city in a given year. High Greenness number indicates a lesser amount of concern about the environment. Our second independent variable is $Green\_invesment_{i,t}$, which is the percentage of turnover invested per year to be more resource efficient. The vector of controls includes a host of firm-specific variables, such as Size, Leverage, ROE, Cash/TA, Growth_sales, Ln(Assets), Volatility, and shock. We use year and industry-fixed effects. Standard errors are clustered at the firm levels.

*To* test for *H1a* and *H1b*: We use the following model specification:

$$\begin{aligned} DIV_{i,t} = {} & \lambda_0 + \lambda_1 Greenness_{i,t} + \lambda_2 Green\_invesment_{i,t} \\ & + \lambda_3 \left(Greenness_{i,t} {}^* Green\_invesment_{i,t}\right) + \eta_1 \left((Controls)_{i,t}\right) \\ & + \sum \varphi_1 Year_I + \sum \varphi_2 Industry_I + \xi_{i,t} \end{aligned} \tag{2}$$

Where, dependent variable $DIV_{i,t}$ is the dividend payment made by company *i* in year *t*, as determined by DIV_dum, DPS, and Payout Ratio.

We use the following model specification to test our H2.

$$\begin{aligned} DIV_{i,t} = {} & \lambda_0 + \lambda_1 Greenness_{i,t} + \lambda_2 Green\_invesment_{i,t} + \lambda_3 Gov_{i,t} \\ & + \lambda_4 \left(Greenness_{i,t} {}^* Green\_invesment_{i,t}\right) + \lambda_5 \left(Greenness_{i,t} {}^* Gov_{i,t}\right) \\ & + \lambda_6 \left(Green\_invesment_{i,t} {}^* Gov_{i,t}\right) \\ & + \lambda_7 \left(Greenness_{i,t} {}^* Green\_invesment_{i,t} {}^* Gov_{i,t}\right) + \left(\eta_1 \left((Controls)_{i,t}\right)\right. \\ & + \sum \varphi_1 Year_I + \sum \varphi_2 Industry_I + \xi_{i,t} \end{aligned} \tag{3}$$

Where, in Equation (2) we include our third independent variable is $Gov_{i,t}$, which represents corporate governance at a firm level, including Independent boards and Board size, Ln(Board). We employ year and industry-fixed effects. Standard errors are clustered at the firm levels.

Finally, as an alternative model specification for H1a and H1b, we use following model:

$$\begin{aligned} AC_{i,t+1} = {} & \lambda_0 + \lambda_1 DIV_{i,t} + \lambda_2 Greenness_{i,t} + \lambda_3 Green\_invesment_{i,t} \\ & + \lambda_4 \left(Greenness_{i,t} {}^* Green\_invesment_{i,t}\right) + \eta_1 \left((Controls)_{i,t}\right) \\ & + \sum \varphi_1 Year_I + \sum \varphi_2 Industry_I + \xi_{i,t} \end{aligned} \tag{4}$$

Where, $AC_{i,t+1}$ is the agency related costs from firm (i) in one year lead (t+1). This is determined in two different fashions: first, by dividing general administrative costs by sales (*Agency Cost-1*). In addition, *Agency Cost- 2* is measured by dividing other receivables by total assets). We use year and industry-fixed effects. Standard errors are clustered at the firm levels. We also use following model specification as our alternative model for H2.

$$\begin{aligned} AC_{i,t+1} = {} & \lambda_0 + \lambda_1 Greenness_{i,t} + \lambda_2 Green\_invesment_{i,t} + \lambda_3 Gov_{i,t} \\ & + \lambda_4 \left(DIV_{i,t} {}^* Greenness_{i,t}\right) + \lambda_5 \left(DIV_{i,t} {}^* Green\_invesment_{i,t}\right) \\ & + \lambda_6 \left(DIV_{i,t} {}^* Gov_{i,t}\right) + \lambda_7 \left(Greenness_{i,t} {}^* Green\_invesment_{i,t}\right) \\ & + \lambda_8 \left(Greenness_{i,t} {}^* Gov_{i,t}\right) + \lambda_9 \left(Green\_invesment_{i,t} {}^* Gov_{i,t}\right) \\ & + \eta_1 \left((Controls)_{i,t}\right) + \sum \varphi_1 Year_I + \sum \varphi_2 Industry_I + \xi_{i,t} \end{aligned} \tag{5}$$

Table 4 presents the summary statistic of the key variables in our models. To enhance the robustness of our analysis, we winsorized our data at the 2.5% threshold to mitigate potential outliers (Das et al., 2024). The findings, as provided in Table 4, confirm a solid foundational

**Table 5**
Pearson Cross-Correlation Matrix
Table 5 presents the Pearson correlation matrix of all independent, dependent and control variables. These variables are defined in Table 1. The results are reported at **5% significance level. The sample period is 2013–2022.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Greenness | 1.000 | | | | | | | | | | | | | | |
| (2) Green_investment | 0.184* | 1.000 | | | | | | | | | | | | | |
| (3) Ind/Board | 0.001 | −0.233* | 1.000 | | | | | | | | | | | | |
| (4) Ln(Board) | 0.214* | 0.074* | −0.116* | 1.000 | | | | | | | | | | | |
| (5) DPS | 0.168* | −0.013 | 0.233* | 0.255* | 1.000 | | | | | | | | | | |
| (6) Payout_ratio | 0.014* | −0.092* | 0.097* | −0.027* | 0.212* | 1.000 | | | | | | | | | |
| (7) DIV_dum | 0.069* | 0.065* | −0.067* | 0.069* | 0.393* | 0.391* | 1.000 | | | | | | | | |
| (8) Size | 0.179* | −0.0022 | 0.237* | 0.387* | 0.458* | 0.003 | 0.063* | 1.000 | | | | | | | |
| (9) Leverage | 0.175* | −0.064* | 0.149* | 0.073* | 0.094* | 0.012 | −0.015 | 0.062* | 1.000 | | | | | | |
| (10) ROE | −0.026* | −0.010 | 0.021 | 0.003 | −0.011 | −0.049* | −0.043* | 0.009 | 0.023 | 1.000 | | | | | |
| (11) Cash/TA | −0.195* | 0.016 | −0.151* | −0.083* | −0.082* | −0.210* | −0.126* | −0.025* | −0.167* | 0.049* | 1.000 | | | | |
| (12) Growth sale | −0.028* | −0.048* | 0.122* | −0.000 | 0.077* | −0.045* | −0.033* | 0.143* | −0.000 | 0.019 | 0.009 | 1.000 | | | |
| (13) Ln(Assets) | 0.342* | 0.059* | 0.096* | 0.466* | 0.353* | 0.074* | 0.111* | 0.644* | 0.081* | −0.016 | −0.203* | 0.036* | 1.000 | | |
| (14) Volatility | 0.046* | 0.124* | −0.111* | 0.002 | −0.121* | −0.197* | −0.088* | −0.082* | −0.047* | 0.029* | 0.0111* | 0.005 | −0.032* | 1.000 | |
| (15) Shock | 0.047* | 0.057* | −0.004* | 0.028* | −0.054* | 0.025* | 0.005 | −0.067 | −0.036 | 0.036* | 0.015* | −0.009* | 0.141* | −0.034* | 1.000 |

**Table 6**
Determinants of greenness and green investment
Table 6 reports the determinants of greenness and green investment. The dependent variables are greenness and green investment. All variables are defined in Table 1. We report the results of the pooled regression with standard errors clustered at the Firm-level dimension. All regressions include year-fixed effects and industry-fixed effects. The results are reported at ***1% significance; **5% significance; *10% significance level. The sample period is 2013–2022.

| Variables | Greenness | Green investment |
|---|---|---|
| Size | 0.011*** | −0.087*** |
| | (0.002) | (0.026) |
| Leverage | 0.019*** | −0.249*** |
| | (0.004) | (0.038) |
| ROE | −0.009 | −0.028 |
| | (0.006) | (0.068) |
| Cash/TA | −0.029*** | −0.098 |
| | (0.007) | (0.074) |
| Growth_sales | −0.048* | −0.550* |
| | (0.028) | (0.294) |
| Ln(Assets) | 0.061*** | 0.154*** |
| | (0.002) | (0.025) |
| Volatility | 0.045 | 3.000*** |
| | (0.032) | (0.336) |
| Shock | −0.005** | −0.039** |
| | (0.012) | (0.125) |
| Year-fixed effects | YES | YES |
| Industry-fixed effects | YES | YES |
| Observation | 7068 | 7068 |
| R-Squared | 0.1931 | 0.0247 |

basis for our analysis.

Notably, the mean and standard deviation values for the 'dividend payout ratio' exhibit a noteworthy elevation when compared to the other two dividend-related variables (the dependent variables). It is important to highlight that the disparity between the minimum (9.181) and maximum (9.858) values of 'size' is marginal. Moreover, Table 4 provides evidence signifying that the mean return on equity (ROE) is clearly low, with the minimum ROE value is in a negative range. This observation stresses the presence of firms within our dataset that have incurred negative ROE.

Table 5 provides the Pearson correlation matrix, capturing the interrelationships among all independent, dependent, and control variables. A visible pattern emerges, wherein 'green investment' establishes a robust and statistically significant positive correlation with 'greenness.' Moreover, a noticeable observation from Table 5 shows a positive and statistically significant correlations between 'greenness' and all three distinct 'dividend variables.' Notably, a positive and statistically significant correlation is also found between the 'dividend dummy variable' and 'green investment.' Furthermore, the correlation matrix shows significant positive correlations between our control variables, 'volatility' and 'shock,' and our independent variables, 'greenness' and 'green investment.' These correlations underline the interplay among the various factors within our analytical framework.

## 4. Empirical findings and discussion

### 4.1. *Determinants of greenness and green investment*

In this study, we provide a thorough examination of the dynamic patterns characterizing firms that diligently track their environmental impact, along with a comprehensive analysis of the factors influencing their level of environmental conscientiousness. It is important to acknowledge that various factors, notably those of an economic nature, exert a significant influence on the extent of 'greenness' exhibited by these enterprises. In this section, we discuss the factors that exert a tangible influence on 'greenness' and 'green investment.' Equation (1) hence is as our analytical tool, to investigate the determinants that steer both 'greenness' and 'green investment,' which constitute our

**Table 7**
Regression of dividend payouts of greenness and green investment
Table 7 reports the regression analysis of greenness and green investment on dividend announcement dates using linear specification. All variables are defined in Table 1. All regressions include year and industry fixed effects. We cluster standard errors at firm dimensions. The results are reported at ***1% significance; **5% significance; *10% significance level. The sample period is 2013–2022.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio |
| $Greenness_{i,t}$ | −0.422*** | −0.351*** | −2.777*** | −2.453*** | −0.093*** | −3.746*** |
| | (0.089) | (0.054) | (1.043) | (0.556) | (0.334) | (6.414) |
| $Green\_invesment_{i,t}$ | 0.104*** | 0.033** | 0.086** | 0.008*** | 0.257** | 0.928** |
| | (0.023) | (0.014) | (0.269) | (0.218) | (0.131) | (0.518) |
| $Ind/Board_{i,t}$ | | | | −0.263*** | −0.179*** | −1.621*** |
| | | | | (0.037) | (0.022) | (0.428) |
| $\ln(Board)_{i,t}$ | | | | −0.130*** | −0.071*** | −0.686*** |
| | | | | (0.031) | (0.018) | (0.352) |
| $Greenness_{i,t}*Green\_invesment_{i,t}$ | −0.453*** | −0.167** | −2.258** | −1.248** | −2.772*** | −0.232*** |
| | (0.129) | (0.079) | (1.519) | (1.223) | (0.735) | (0.109) |
| $Greenness_{i,t}*Ind/Board_{i,t}$ | | | | −1.493*** | −2.256* | −3.746*** |
| | | | | (0.256) | (0.154) | (2.950) |
| $Greenness_{i,t}*\ln(Board)_{i,t}$ | | | | −0.803*** | −0.153* | −0.856*** |
| | | | | (0.216) | (0.129) | (0.489) |
| $Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | 0.087 | 0.078* | 4.345*** |
| | | | | (0.081) | (0.049) | (0.934) |
| $Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | 0.021 | 0.104** | 0.191** |
| | | | | (0.088) | (0.053) | (1.018) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | −0.737*** | −0.275*** | −0.591*** |
| | | | | (0.455) | (0.274) | (0.251) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | −0.499*** | −1.134*** | −1.088*** |
| | | | | (0.489) | (0.295) | (5.651) |
| Controls | YES | YES | YES | YES | YES | YES |
| Year-fixed effects | YES | YES | YES | YES | YES | YES |
| Industry-fixed effects | YES | YES | YES | YES | YES | YES |
| Observation | 7068 | 7068 | 7068 | 7068 | 7068 | 7068 |
| R-Squared | 0.0481 | 0.2197 | 0.0475 | 0.0574 | 0.2487 | 0.0853 |

dependent variables (as outlined in Table 1).

Furthermore, our regression framework incorporates an extensive collection of firm-level factors, encompassing Size, Leverage, Return on Equity (ROE), Cash to Total Assets Ratio (Cash/TA), Sales Growth Rate (Growth_sales), Natural Logarithm of Total Assets (Ln(Assets)), Volatility, and Shock. It is essential to stress that the complex nature of carbon emissions sources makes it difficult to rely solely on established theoretical frameworks for a complete understanding.

To mitigate the potential for firm-level emissions to cluster, we have undertaken an appropriate statistical approach by clustering standard errors at the firm level. Detailed results are presented in Table 6.

As expected, the findings in Table 6 reveal a noteworthy and positive association between the natural logarithm of firm size (Log size) and 'greenness.' Conversely, the association observed in Table 6 between 'Log size' and 'green investment' is discernibly negative, yet statistically significant. Additionally, Table 6 sheds light on the robust link between 'Ln(Assets),' 'volatility,' and emission levels, underscoring their strong positive associations.

However, Table 6 also highlights a distinct negative and statistically significant relationship between 'green investment' and 'shock' when the latter happens. This adverse association can be attributed, in part, to the destructive effects of economic shocks on firms' productivity levels, which exert a negative influence on their capacity for 'green investment'.

### 4.2. Empirical test of location greenness and green investment on dividend payout (baseline model)

Table 7 presents the baseline regression model. Column (1–3) presents the regression results based on Equation (2) and Column (4–6) presents the regression results based on Equation (3). In Table 7 Column (1), the results shows that when dependent variable is DIV_dum, and coefficient value on Greenness is −0.422 (and at 0.01 significance), demonstrating that 1% increase in Greenness reduce a firm's tendency of dividend payments by around 0.422%. Columns (2) and (3) report dividend payment and dividend payout ratio and coefficient value on greenness is −0.351 and −2.777, respectively. Both are at 0.01 significant level, suggesting that 1% increase in Greenness reduce a firm's tendency of dividend payments and dividend payout ratio by about 0.351 and 2.777 respectively. These results are consistent with previous literature (Eckbo et al., 2018; Wang et al., 2022) and our hypothesis H1a and H1b. We report similar results in Column (4)–(6), indicating that our hypothesis H2 is true. These findings suggest that companies in more polluted locations are more inclined to distribute dividends or distribute payments in greater amounts in order to lessen the unfavorable perception of local area air pollution.

On the other hand, in Table 7 Column (1), we show that when dependent variable is DIV_dum and coefficient value on Green Investment is 0.104 and significant is 0.01 level, demonstrating that and surge of 1% Green Investment reduce a firm 's tendency of dividend payment by around 0.104%. Similar results are found in Columns (2) and (3), where when dependent variables are dividend payment and dividend payout ratio, our results show an 1% increase of Green investment will reduce a business tendency of dividend payment around 0.033% and 0.086%, respectively. Column (4)–(6) also showing similar kind of results. These results indicate that our results align with our H2. These results indicate that firms are less willing to increase dividend payment if they invest more in green investment.

In Columns (4)–(6) of Table 7, we investigate the relationship between independent board members and Ln(Board) with our dependent variables. Notably, the results reveal negative coefficient values, all of which are statistically significant at the 0.01 level. Furthermore, in Columns (4)–(6), when we introduce the interaction between Greenness and Green Investment, we observe consistently negative and statistically significant results. These findings shows that firms situated in areas with higher pollution levels tend to pay higher dividends, whereas firms that invest more in green initiatives exhibit a reduced inclination to increase dividend payments (D'Angelo et al., 2023; Wang et al., 2022).

**Table 8**
Regression of dividend payouts on greenness and green investment based on growth potential
Table 8 reports the regression analysis of greenness and green investment on dividend announcement dates using linear specification based on growth potential (revenue of the firm). In here Panel A present the low growth firms (< median growth rate), and Panel B present the high growth (≥median growth rate). All variables are defined in Table 1. All regressions include year and industry fixed effects. We cluster standard errors at firm dimensions. The results are reported at ***1% significance; **5% significance; *10% significance level. The sample period is 2013–2022.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio |
| *Panel A: Low growth (< median growth rate)* | | | | | | |
| $Greenness_{i,t}$ | −0.281** | −0.359** | −0.409** | −0.078** | −0.145** | −0.181** |
| | (0.122) | (0.076) | (1.476) | (0.768) | (0.475) | (9.145) |
| $Green\_invesment_{i,t}$ | 0.093*** | 0.026** | 0.071*** | 0.060*** | 0.372** | 0.290** |
| | (0.030) | (0.019) | (0.365) | (0.311) | (0.192) | (3.713) |
| $Ind/Board_{i,t}$ | | | | −0.203*** | −0.172*** | −0.382** |
| | | | | (0.050) | (0.031) | (0.601) |
| $\ln(Board)_{i,t}$ | | | | −0.168*** | −0.075* | −3.832*** |
| | | | | (0.042) | (0.026) | (0.503) |
| $Greenness_{i,t}*Green\_invesment_{i,t}$ | −0.369** | −0.203** | −3.307** | −1.833*** | −3.072*** | −0.113*** |
| | (0.171) | (0.107) | (2.079) | (1.711) | (1.053) | (0.397) |
| $Greenness_{i,t}*Ind/Board_{i,t}$ | | | | −1.283*** | −0.149*** | −12.287*** |
| | | | | (0.348) | (0.183) | (4.152) |
| $Greenness_{i,t}*\ln(Board)_{i,t}$ | | | | −1.081*** | −0.234** | −23.754*** |
| | | | | (0.297) | (0.183) | (3.534) |
| $Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | 0.004 | 0.109* | 3.055*** |
| | | | | (0.104) | (0.064) | (1.235) |
| $Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | 0.063 | 0.141** | 0.235** |
| | | | | (0.124) | (0.076) | (1.480) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | −0.249* | −0.441** | −3.832** |
| | | | | (0.589) | (0.362) | (7.018) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | −0.837** | −1.228** | −0.024** |
| | | | | (0.677) | (0.417) | (8.064) |
| Controls | YES | YES | YES | YES | YES | YES |
| Year-fixed effects | YES | YES | YES | YES | YES | YES |
| Industry-fixed effects | YES | YES | YES | YES | YES | YES |
| Observation | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 |
| R-Squared | 0.0732 | 0.2255 | 0.0746 | 0.0829 | 0.2569 | 0.1165 |
| *Panel B: High growth (>= median growth rate)* | | | | | | |
| $Greenness_{i,t}$ | −0.593*** | −0.343*** | −3.783*** | −1.383*** | −0.295*** | −0.709*** |
| | (0.133) | (0.079) | (1.514) | (0.826) | (0.488) | (0.268) |
| $Green\_invesment_{i,t}$ | 0.101*** | 0.033** | 0.283** | 0.033** | 0.185** | 0.118** |
| | (0.036) | (0.021) | (0.409) | (0.314) | (0.186) | (0.522) |
| $Ind/Board_{i,t}$ | | | | −0.299*** | −0.184*** | −2.601*** |
| | | | | (0.056) | (0.033) | (0.629) |
| $\ln(Board)_{i,t}$ | | | | −0.068** | −0.099*** | −3.656*** |
| | | | | (0.045) | (0.027) | (0.510) |
| $Greenness_{i,t}*Green\_invesment_{i,t}$ | −0.472** | −0.077** | −0.083** | −0.569*** | −2.767*** | −9.828*** |
| | (0.201) | (0.120) | (2.288) | (1.805) | (1.067) | (0.257) |
| $Greenness_{i,t}*Ind/Board_{i,t}$ | | | | −1.549*** | −0.391* | −12.526*** |
| | | | | (0.386) | (0.229) | (4.336) |
| $Greenness_{i,t}*\ln(Board)_{i,t}$ | | | | −0.389** | −0.098** | −0.684*** |
| | | | | (0.321) | (0.190) | (0.606) |
| $Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | 0.139 | 0.035 | 5.133*** |
| | | | | (0.134) | (0.079) | (1.500) |
| $Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | 0.011 | 0.084 | 0.027 |
| | | | | (0.129) | (0.077) | (1.453) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | −0.971*** | −0.089*** | −8.694*** |
| | | | | (0.741) | (0.438) | (8.316) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | −0.159*** | −1.149*** | −2.262*** |
| | | | | (0.737) | (0.436) | (8.267) |
| Controls | YES | YES | YES | YES | YES | YES |
| Year-fixed effects | YES | YES | YES | YES | YES | YES |
| Industry-fixed effects | YES | YES | YES | YES | YES | YES |
| Observation | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 |
| R-Squared | 0.0455 | 0.2217 | 0.0398 | 0.0546 | 0.2490 | 0.0800 |

Similarly, when examining the interactions between Greenness, Green Investment, independent board members, and Ln(Board), we again find that both coefficient values are negative and statistically significant at the 0.01 level. These results align with our hypotheses and are consistent with prior literature. In summary, the results of our control variables are generally consistent with our expectations and previous research.

### 4.3. *Potential for business growth*

Even if our main regressions account for the prospective firm growth, the negative association between dividends and greenness and the positive association between green investment and dividends could potentially encompass variations in growth potential associated with diverse geographic regions. To examine this notion, we categorize businesses into high-growth and low-growth categories based on their

**Table 9**
Regression of dividend payouts on greenness and green investment based on different agency cost
Table 9 reports the regression analysis of greenness and green investment on dividend announcement dates using linear specification based on different agency cost. Panel A present the Agency cost 1, measured using ratio of general administrative expenses to sales. Panel B present the Agency cost 2, measured using ratio of other receivables to total assets. All variables are defined in Table 1. All regressions include year and industry fixed effects. We cluster standard errors at firm dimensions. The results are reported at ***1% significance; **5% significance; *10% significance level. The sample period is 2013–2022.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio |
| | Panel A: Agency cost 1 Low agency cost 1 (<median) | | | | | | High agency cost 1 (≥median) | | | | | |
| $Greenness_{i,t}$ | −0.583** | −0.151** | −2.727** | −1.993** | −0.388** | −0.207** | −0.406*** | −0.608*** | −9.384*** | −3.471*** | −0.714** | −0.717*** |
| | (0.121) | (0.078) | (1.501) | (0.765) | (0.487) | (0.315) | (0.135) | (0.079) | (1.490) | (0.846) | (0.489) | (0.289) |
| $Green\_invesment_{i,t}$ | 0.088** | 0.005** | 0.403** | 0.196** | 0.330** | 2.369** | 0.149*** | 0.123*** | 1.709*** | 0.138*** | 0.769*** | 0.636*** |
| | (0.024) | (0.015) | (0.295) | (0.220) | (0.141) | (0.685) | (0.079) | (0.046) | (0.871) | (0.073) | (0.620) | (0.779) |
| $Ind/Board_{i,t}$ | | | | −0.314*** | −0.204*** | −1.920*** | | | | −0.210*** | −0.181*** | −0.625*** |
| | | | | (0.046) | (0.029) | (0.559) | | | | (0.062) | (0.036) | (0.681) |
| $\ln(Board)_{i,t}$ | | | | −0.132*** | −0.071*** | −4.164*** | | | | −0.154*** | −0.121*** | −3.118*** |
| | | | | (0.039) | (0.025) | (0.480) | | | | (0.048) | (0.028) | (0.525) |
| $Greenness_{i,t}*Green\_invesment_{i,t}$ | −0.359*** | −0.009** | −0.649** | −0.308** | −3.813*** | −0.451** | −0.688** | −0.601** | −11.219*** | −0.859*** | −0.478*** | −0.639*** |
| | (0.142) | (0.091) | (1.771) | (1.334) | (0.850) | (0.247) | (0.403) | (0.237) | (4.449) | (0.349) | (0.094) | (0.762) |
| $Greenness_{i,t}*Ind/Board_{i,t}$ | | | | −1.525*** | −0.751*** | −0.915*** | | | | −1.425*** | −0.065** | −0.087*** |
| | | | | (0.339) | (0.216) | (0.134) | | | | (0.400) | (0.232) | (0.398) |
| $Greenness_{i,t}*\ln(Board)_{i,t}$ | | | | −0.672*** | −0.093*** | −0.070*** | | | | −1.205*** | −0.088** | −0.254*** |
| | | | | (0.297) | (0.191) | (0.624) | | | | (0.324) | (0.188) | (0.562) |
| $Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | 0.058 | 0.054 | 3.750*** | | | | 0.188 | 0.198 | 0.382 |
| | | | | (0.082) | (0.052) | (1.001) | | | | (0.342) | (0.198) | (0.761) |
| $Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | 0.066 | 0.131** | 0.065** | | | | 0.045 | 0.298 | 1.829 |
| | | | | (0.090) | (0.057) | (0.097) | | | | (0.384) | (0.222) | (0.219) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | −0.210** | −0.109** | −0.127** | | | | −1.536** | −0.835** | −0.182*** |
| | | | | (0.497) | (0.317) | (0.49) | | | | (1.318) | (0.994) | (0.877) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | −0.071** | −1.560*** | −0.813*** | | | | −0.231*** | −1.755*** | −0.916** |
| | | | | (0.534) | (0.341) | (0.512) | | | | (1.921) | (1.111) | (0.098) |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Year-fixed effects | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Industry-fixed effects | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observation | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 |
| R-Squared | 0.0441 | 0.1799 | 0.0615 | 0.0618 | 0.2133 | 0.1174 | 0.0694 | 0.2528 | 0.0542 | 0.0775 | 0.2843 | 0.0730 |
| | Panel B: Agency cost 2 Low agency cost 2 (<median) | | | | | | High agency cost 2 (≥median) | | | | | |
| $Greenness_{i,t}$ | −0.370*** | −0.171*** | −0.254** | −0.717*** | −1.061*** | −0.363*** | −0.406*** | −0.476*** | −4.094*** | −4.415*** | −1.082** | −0.721*** |
| | (0.127) | (0.083) | (1.661) | (0.746) | (0.473) | (0.601) | (0.136) | (0.077) | (1.424) | (0.868) | (0.487) | (0.955) |
| $Green\_invesment_{i,t}$ | 0.068** | 0.079*** | 1.540*** | 0.161*** | 0.582** | 0.968*** | 0.122*** | 0.019** | 0.569** | 0.084*** | 0.059** | 0.397*** |
| | (0.039) | (0.025) | (0.503) | (0.378) | (0.241) | (0.864) | (0.031) | (0.018) | (0.326) | (0.289) | (0.162) | (0.983) |
| $Ind/Board_{i,t}$ | | | | −0.006*** | −0.226*** | −2.548*** | | | | −0.481*** | −0.131*** | −0.844*** |
| | | | | (0.053) | (0.034) | (0.683) | | | | (0.055) | (0.031) | (0.568) |
| $\ln(Board)_{i,t}$ | | | | −0.046*** | −0.146*** | −0.417*** | | | | −0.229*** | −0.015** | −3.234*** |
| | | | | (0.041) | (0.026) | (0.524) | | | | (0.047) | (0.026) | (0.885) |
| $Greenness_{i,t}*Green\_invesment_{i,t}$ | −0.400** | −0.407*** | −10.799*** | −2.700*** | −3.428*** | −0.171*** | −0.423*** | −0.041** | −0.574** | −1.291*** | −2.400*** | −1.951*** |
| | (0.204) | (0.133) | (2.673) | (2.033) | (1.291) | (0.174) | (0.186) | (0.104) | (1.937) | (1.668) | (0.935) | (0.215) |
| $Greenness_{i,t}*Ind/Board_{i,t}$ | | | | −0.067** | −0.265** | −0.656*** | | | | −2.657*** | −0.407** | −0.676*** |
| | | | | (0.361) | (0.228) | (0.629) | | | | (0.391) | (0.219) | (0.039) |
| $Greenness_{i,t}*\ln(Board)_{i,t}$ | | | | −0.434** | −0.337** | −0.082*** | | | | −1.349*** | −0.761*** | −0.683*** |
| | | | | (0.279) | (0.177) | (0.585) | | | | (0.344) | (0.193) | (0.551) |
| $Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | 0.190 | 0.002 | 0.649*** | | | | 0.102 | 0.112* | 3.300*** |
| | | | | (0.138) | (0.088) | (0.779) | | | | (0.112) | (0.063) | (1.153) |

(continued on next page)

**Table 9** (*continued*)

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio |
| $Green\_invesment_{i,t}$*$\ln(Board)_{i,t}$ | | | | 0.039 | 0.285*** | 1.049*** | | | | 0.060 | 0.005 | 0.408 |
| | | | | (0.146) | (0.093) | (1.885) | | | | (0.118) | (0.066) | (1.221) |
| $Greenness_{i,t}$*$Green\_invesment_{i,t}$*$Ind/Board_{i,t}$ | | | | −1.274** | −0.095** | −0.994*** | | | | −0.616*** | −0.265*** | −0.486*** |
| | | | | (0.744) | (0.472) | (0.573) | | | | (0.654) | (0.367) | (0.747) |
| $Greenness_{i,t}$*$Green\_invesment_{i,t}$*$\ln(Board)_{i,t}$ | | | | −0.907** | −1.635*** | −0.852*** | | | | −0.545*** | −0.923*** | −0.145*** |
| | | | | (0.783) | (0.497) | (0.081) | | | | (0.677) | (0.379) | (0.987) |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Year-fixed effects | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Industry-fixed effects | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observation | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 | 3534 |
| R-Squared | 0.0507 | 0.2597 | 0.0397 | 0.0548 | 0.2969 | 0.0742 | 0.0547 | 0.1863 | 0.0691 | 0.0801 | 0.2124 | 0.1136 |

annual sales growth rates. If a company's sales growth rate in a given year is less than (equal to or more than) the median growth rate, it is classed as having low (or high) growth. Subsequently, we estimate equations (1) and (2) for the subgroups characterized by low and high growth, respectively.

Panel A in Table 8 presents the low growth group and Panel B in Table 8 shows the high growth group. Both panels show that the magnitude of coefficient of Greenness in low growth group (panel A) slightly low compared to high growth group (panel B), also Greenness coefficient values are statistically more significant in high growth group than low growth group (Wang et al., 2022). Similar results for Green Investment in Table 8 are reported. From Table 8 we find that green investment coefficient value in all six Columns (Column (1)–(6)) are higher for high growth group than low growth group, also, low growth group is statistically less significant than high growth group (D'Angelo et al., 2023). But when our both independent variables interact with each other then we cannot report much difference between the two panels. On the other hand, when both of these two independent variables together interact with independent board and Ln(Board) then still we can observe similar kind of results. This outcome supports the findings in Table 6 and shows that there is a negative relationship between dividends and growth rate.

### 4.4. Greenness, green investment effect and agency cost

Considering that dividend payouts are a recognized strategy for mitigating agency problems, it is reasonable to infer, based on previous research, that the practice of impression management through dividend payouts becomes more significant in situations where agency problems are more pronounced (Denis and Osobov, 2006; Easterbrook, 1984; Brav et al., 2005; Hasan, 2021a, 2022; Jensen, 1986; La Porta et al., 2000). To examine our hypothesis, we categorized all businesses into low-agency cost and those with high-agency cost groups, using the median agency cost for all companies within a given year as the threshold. We employed two measures of agency costs, as outlined by Ang et al. (2000): "*the general administration costs to sales* and the *other receivables to total assets*."

The outcomes based on, our first measurement, (Agency cost-1) are reported in Panel A of Table 9. From Column (1) to Column (6), Greenness of the low-agency category is negative, but they are only at 0.05 level of significance. In contrast, the high-agency cost subsample's Greenness coefficients are negative and statistically (0.01 level significant) (Columns (7–12). Additionally, compared to the coefficients for the low-agency cost subsample, those for the high-agency cost subsample have a bigger magnitude. In a similar vein, green investment for the low-agency category is positive, but only from Column (1) through Column (6) are they significant at the 0.05 level. On the other hand, for the high-agency cost subsample (Columns 7–12), the coefficients on green investment are positive and significant at the 0.01 level. Additionally, compared to the coefficients for the low-agency cost subsample, those for the high-agency cost subsample have a bigger magnitude. We also, show that when greenness and Green Investment interact with each other, our results are negative for all twelve Columns, but high agency cost 1 coefficient value are stronger in magnitude and statistically stronger than low agency cost 1. The results based on Agency cost- 2 are reported in Panel B of Table 9, and the outcomes are comparable.

### 4.5. Other stakeholders' benefit

Our findings demonstrate that companies situated in more polluted areas tend to offer higher dividends as a strategic response to mitigate the adverse perception of their environments. Shareholders, as a result, stand to benefit significantly from these dividend payments. However, our prior findings also reveal that businesses may reduce dividend payments or exhibit less inclination to increase them when they allocate more resources towards green investments. This raises questions about the broader implications for stakeholders, particularly in light of the

**Table 10**
Regression of agency costs on actual and predicted dividend payouts on greenness and green investment
Table 10 reports the regression of agency costs on actual and predicted dividend payouts on greenness and green investment using linear specification based on different agency cost. In Panel A dependent variable is the Agency cost 1, measured using ratio of general administrative expenses to sales. In Panel B dependent variable is the Agency cost 2, measured using ratio of other receivables to total assets. All variables are defined in Table 1. All regressions include year and industry fixed effects. We cluster standard errors at firm dimensions. The results are reported at ***1% significance; **5% significance; *10% significance level. The sample period is 2013–2022.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Panel A: Agency cost 1 | | | | | | |
| Div_dum | −0.367*** | | | | | |
| | (0.096) | | | | | |
| DPS | | −0.846*** | | | | |
| | | (0.156) | | | | |
| Payout_ratio | | | −0.031*** | | | |
| | | | (0.009) | | | |
| $Greenness_{i,t}$ | −4.101*** | −5.183*** | −4.781*** | −0.884*** | −0.914*** | −0.597*** |
| | (0.735) | (0.792) | (1.016) | (0.435) | (0.384) | (0.538) |
| $Green\_invesment_{i,t}$ | 0.275*** | 0.283*** | 0.235** | 0.468*** | 0.492*** | 0.415*** |
| | (0.166) | (0.181) | (0.137) | (0.353) | (0.325) | (0.329) |
| $Ind/Board_{i,t}$ | | | | −0.042*** | −0.141*** | −0.130*** |
| | | | | (0.342) | (0.253) | (0.330) |
| $\ln(Board)_{i,t}$ | | | | −1.152*** | −0.810*** | −0.661*** |
| | | | | (0.232) | (0.221) | (0.278) |
| $Greenness_{i,t}*Div_{i,t}$ | | | | −1.466*** | −2.736*** | −0.143*** |
| | | | | (0.752) | (1.159) | (0.063) |
| $Green\_invesment_{i,t}*Div_{i,t}$ | | | | 0.158*** | 0.187*** | 0.003*** |
| | | | | (0.139) | (0.174) | (0.010) |
| $Div_{i,t}*Ind/Board_{i,t}$ | | | | 0.705*** | 0.598** | 0.053*** |
| | | | | (0.261) | (0.343) | (0.019) |
| $Div_{i,t}*\ln(Board)_{i,t}$ | | | | 0.530*** | 0.854*** | 0.011** |
| | | | | (0.207) | (0.296) | (0.016) |
| $Greenness_{i,t}*Green\_invesment_{i,t}$ | −0.344*** | −0.212*** | −0.498*** | −0.286*** | −0.216** | −0.477*** |
| | (0.571) | (0.578) | (0.572) | (0.589) | (0.601) | (0.590) |
| $Greenness_{i,t}*Ind/Board_{i,t}$ | | | | −3.723*** | −3.380*** | −3.082*** |
| | | | | (1.087) | (1.118) | (1.082) |
| $Greenness_{i,t}*\ln(Board)_{i,t}$ | | | | −1.031*** | −0.058** | −1.133*** |
| | | | | (0.921) | (0.948) | (0.921) |
| $Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | 0.039** | 0.035*** | 0.028*** |
| | | | | (0.121) | (0.129) | (0.134) |
| $Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | 0.091** | 0.131*** | 0.097** |
| | | | | (0.127) | (0.127) | (0.127) |
| Controls | YES | YES | YES | YES | YES | YES |
| Year-fixed effects | YES | YES | YES | YES | YES | YES |
| Industry-fixed effects | YES | YES | YES | YES | YES | YES |
| Observation | 7068 | 7068 | 7068 | 7068 | 7068 | 7068 |
| R-Squared | 0.1420 | 0.1438 | 0.1416 | 0.1509 | 0.1478 | 0.1469 |
| Panel B: Agency cost 2 | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Div_dum | −0.017*** | | | | | |
| | (0.005) | | | | | |
| DPS | | −0.002*** | | | | |
| | | (0.008) | | | | |
| Payout_ratio | | | −0.003*** | | | |
| | | | (0.003) | | | |
| $Greenness_{i,t}$ | −0.181*** | −0.106*** | −0.295*** | −0.609*** | −0.551*** | −0.815*** |
| | (0.041) | (0.043) | (0.055) | (0.131) | (0.129) | (0.137) |
| $Green\_invesment_{i,t}$ | 0.015*** | 0.008** | 0.010*** | 0.029*** | 0.028*** | 0.039*** |
| | (0.009) | (0.007) | (0.009) | (0.019) | (0.018) | (0.018) |
| $Ind/Board_{i,t}$ | | | | −0.087*** | −0.067*** | −0.105*** |
| | | | | (0.014) | (0.014) | (0.017) |
| $\ln(Board)_{i,t}$ | | | | −0.052*** | −0.004*** | −0.046*** |
| | | | | (0.012) | (0.012) | (0.015) |
| $Greenness_{i,t}*Div_{i,t}$ | | | | −0.114*** | −0.022*** | −0.014*** |
| | | | | (0.039) | (0.063) | (0.003) |
| $Green\_invesment_{i,t}*Div_{i,t}$ | | | | 0.012*** | 0.012*** | 0.021*** |
| | | | | (0.008) | (0.009) | (0.001) |
| $Div_{i,t}*Ind/Board_{i,t}$ | | | | 0.046*** | 0.039** | 0.004*** |
| | | | | (0.013) | (0.019) | (0.001) |
| $Div_{i,t}*\ln(Board)_{i,t}$ | | | | 0.011*** | 0.059*** | 0.002*** |
| | | | | (0.015) | (0.016) | (0.001) |
| $Greenness_{i,t}*Green\_invesment_{i,t}$ | −0.064** | −0.079** | −0.076** | −0.037*** | −0.045*** | −0.047** |
| | (0.031) | (0.032) | (0.031) | (0.032) | (0.033) | (0.032) |
| $Greenness_{i,t}*Ind/Board_{i,t}$ | | | | −0.040*** | −0.017** | −0.031*** |
| | | | | (0.059) | (0.061) | (0.058) |
| $Greenness_{i,t}*\ln(Board)_{i,t}$ | | | | −0.176*** | −0.199*** | −0.220*** |

(continued on next page)

**Table 10** (*continued*)

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | | | (0.050) | (0.051) | (0.051) |
| $Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | 0.001** | 0.002*** | 0.006*** |
| | | | | (0.006) | (0.007) | (0.007) |
| $Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | 0.007*** | 0.006*** | 0.008*** |
| | | | | (0.007) | (0.007) | (0.007) |
| Controls | YES | YES | YES | YES | YES | YES |
| Year-fixed effects | YES | YES | YES | YES | YES | YES |
| Industry-fixed effects | YES | YES | YES | YES | YES | YES |
| Observation | 7068 | 7068 | 7068 | 7068 | 7068 | 7068 |
| R-Squared | 0.0712 | 0.0700 | 0.0787 | 0.0868 | 0.0863 | 0.0950 |

ethical imperative to ensure fair and equitable distribution of resources among stakeholders, as advocated in the sustainable corporate finance literature (Bohren et al., 2012; Gallo, 2004; Hasan, 2021b; Hasan and Islam, 2022; He et al., 2012; Soppe, 2004).

In order to investigate this, we examine whether dividend payments, especially those influenced by a firm's geographical greenness and green investment, have an impact on the firm's agency costs. This investigation is motivated by the notion that a reduction in agency costs can be advantageous for all stakeholders. We address this inquiry by employing equations (4) and (5).

The percentage of general administration costs to sales is how we quantify agency costs in Panel A of Table 10. The independent variable $Div_{i,t}$ in Columns (1–6) represents the actual amounts of DIV_dum, DPS, and Payout Ratios. These variables have negative coefficients that are statistically significant at 0.01 level, revealing that dividend payments can lower agency costs. However, different factors, including those that might not be connected to a company's location greenness or green investment, might have an impact on its dividend policy (Brav et al., 2005). We examine the impact of dividends anticipated based on the *geographical greenness* and *green investment* on agency related costs to focus on the stakeholder welfare and strategic deterrent impacts. By proliferating the coefficient on Greenness and Green Investment derived from the $Div_{i,t}$ regression in equations (4) and (5) by the actual value of Greenness and Green Investment, we can calculate the anticipated dividends. For instance, the independent variable Div_dum's projected value in Columns (1) through (6) of Panel A in Table 10 has separate interactions with Greenness and Green Investment (see equations (4) and (5)). The expected values of our variables "DPS and Payout Ratios" are treated using the same methodology.

The outcomes using anticipated DIV as independent variables are reported in Columns (4–6) of Panel A of Table 10. The magnitude of all the negative coefficients on expected dividend variables that are significant at the 0.01 level is greater than the size of the coefficients in Columns (1) through (3). Economically, the interaction between Greenness and Div_dum in Column (4) results in a negative coefficient of −1.466, which indicates that as the firm's location's greenness increases by 1%, agency costs drop by about 1.47%. According to the coefficient of −0.367 on Div_dum in Column (1), the company's agency costs are decreased by just about 0.37 percent when the potential of dividend payments increase by 1%. Similar to this, the negative signs in Columns (5–6) show that 1% increase in anticipated dividend measures reduces agency related costs by approximately 2.74% and 0.143%, respectively. On the other hand, all of the outcomes in Columns (4) through (6) are favorable and statistically significant at the 0.01 level when Green Investment interacts with DIV independent variables (DIV_dum, DPS, and Dividend payout ratio). According to these findings, when a company increases its green investment by 1%, its agency expenses rise by about 0.16% (as shown by the formula $Green\_invesment_{i,t}*Div\_dum_{i,t} = 0.158$). Similarly, the positive coefficients of 0.187 and 0.002 in Columns (5–6) show that 1% rise in anticipated dividend measures increases agency related costs by approximately 0.19% and 0.002%, respectively.

In Panel B of Table 10 (Agency cost- 2), the results of calculating agency cost using the other receivables to total assets ratio are presented. Div-dum, DPS, and payout_ratio in Columns (1–3) are 0.017, 0.002, and −0.003, respectively. In Columns (4–6), the dividend variables indicated by location greenness have coefficients of −0.114, −0.022, and −0.014, while the dividend variables predicted by green investment have coefficients of −0.012, −0.012, and −0.021. These coefficients are more significant at 1% and greater than those reported. in Columns (1–3). The data demonstrates that dividend payments typically reduce agency costs and are advantageous to stakeholders. Notably, because of the larger agency cost reduction, dividend payments arising from stakeholders' environmental issues are more beneficial.

### 4.6. Pre and during Covid-19 effect on greenness and green investment

This section outlines the alternate test we conducted using Equations (2) and (3) to corroborate our initial findings. Initially, we divided the entire sample into two distinct subsamples based on shocks. Table 11 presents the results from the shock subsample, where we specifically consider the shock periods (2013–2019, before the Covid–19 period, and 2020–2022, during the Covid-19 period) to assess the pre- and during-Covid-19 effects on greenness and green investment. The results in Table 11 are solely based on interaction model settings, with Panel A representing the Covid-19 period (2020–2022) and Panel B covering the pre–Covid-19 period (2013–2019).

Given that this alternative test focuses on a shock subsample, there is a possibility that certain control factors may not be fully accounted for when considering only the shock variable. To address this concern, we also factor in the effects of industry and year in conducting this test. Furthermore, all standard errors are clustered using firm-level dimensions.

Panel A in Table 11, we can see that Greenness and Green Investment variables coefficients values in Columns (1)–(6) are not statistically significant. We can observe that our third independent variable $Gov_{i,t}$ also not statistically significant. This mainly because during Covid-19 period (2020–2022) firms' production was low and that's why even polluted firms did not pay large amount of dividend and firms also make less green investment. On the other hand, Panel B in Table 11 shows that Greenness and Green Investment variables coefficients values in Columns (7–12) are statistically significant at 0.01 level and signs are consistent with our hypothesis and previous literature. All the variables including interaction variables pre Covid-19 period are statistically significant, this is because pre Covid-19 period firms production level was consistent and polluted firms were paying more dividend to compensate their shareholder and firms were unwilling to increase dividend because they were trying to make more green investment.

### 4.7. GMM estimation (using baseline model)

We incorporated eight distinct control factors in our model parameters to mitigate potential bias stemming from omitted variables. However, the presence of reverse causality raises concerns about the accuracy of our findings. To address this issue and potential endogeneity problems, we employed the Two-Step System GMM dynamic panel estimation approach, as recommended by Arellano and Bond (1991,

**Table 11**

Regression of dividend payouts of greenness and green investment using sub−period: 2020–2022 (COVID−19 period)

Table 11 reports the regression of dividend payouts of greenness and green investment using sub−period: 2020–2022 (COVID−19 period) using linear specification. Panel A presents during Covid-19 period (2020–2022). Panel B presents before Covid-19 period (2013–2019). All variables are defined in Table 1. All regressions include year and industry fixed effects. We cluster standard errors at firm dimensions. The results are reported at ***1% significance; **5% significance; *10% significance level. The sample period is 2013–2022.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio |
| | Panel A: During Covid-19 (2020–2022) | | | | | | Panel B: Before Covid-19 (2013–2019) | | | | | |
| $Greenness_{i,t}$ | −0.407 | −0.257 | −1.601 | −0.437 | −0.254 | −0.801 | −0.421*** | −0.369*** | −3.529*** | −2.321*** | −0.141*** | −0.823*** |
| | (0.277) | (0.151) | (2.829) | (0.753) | (0.944) | (0.717) | (0.094) | (0.059) | (1.137) | (0.584) | (0.365) | (0.983) |
| $Green\_invesment_{i,t}$ | 0.065 | 0.005 | 0.196 | 0.171 | 0.435 | 0.105 | 0.112*** | 0.037** | 0.033*** | 0.027*** | 0.241*** | 0.546*** |
| | (0.071) | (0.039) | (0.733) | (0.816) | (0.439) | (0.251) | (0.024) | (0.015) | (0.094) | (0.226) | (0.141) | (0.704) |
| $Ind/Board_{i,t}$ | | | | −0.246 | −0.196 | −1.372 | | | | −0.227*** | −0.175*** | −1.637*** |
| | | | | (0.121) | (0.065) | (1.219) | | | | (0.038) | (0.024) | (0.463) |
| $\ln(Board)_{i,t}$ | | | | −0.108 | −0.080 | −3.785 | | | | −0.133*** | −0.069*** | −3.683*** |
| | | | | (0.098) | (0.052) | (0.985) | | | | (0.032) | (0.020) | (0.383) |
| $Greenness_{i,t}*Green\_invesment_{i,t}$ | −0.244 | −0.020 | −0.128 | −1.459 | −4.409 | −0.083 | −0.498*** | −0.188** | −2.795** | −1.181** | −2.595*** | −0.347*** |
| | (0.409) | (0.224) | (0.190) | (4.528) | (2.438) | (0.762) | (0.136) | (0.086) | (1.655) | (1.267) | (0.791) | (0.147) |
| $Greenness_{i,t}*Ind/Board_{i,t}$ | | | | −2.128 | −0.324 | −0.569 | | | | −1.143*** | −0.241*** | −0.409*** |
| | | | | (0.839) | (0.452) | (0.481) | | | | (0.266) | (0.166) | (0.185) |
| $Greenness_{i,t}*\ln(Board)_{i,t}$ | | | | −0.988 | −0.266 | −0.107 | | | | −0.771*** | −0.138** | −0.977*** |
| | | | | (0.699) | (0.376) | (0.062) | | | | (0.226) | (0.141) | (0.700) |
| $Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | 0.004 | 0.098 | 2.077 | | | | 0.122** | 0.081** | 0.629*** |
| | | | | (0.267) | (0.144) | (2.703) | | | | (0.084) | (0.053) | (1.009) |
| $Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | 0.055 | 0.162 | 0.594 | | | | 0.025*** | 0.098** | 0.418** |
| | | | | (0.346) | (0.0186) | (0.501) | | | | (0.091) | (0.057) | (1.087) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | −1.278 | −0.471 | −0.308 | | | | −0.781** | −0.269*** | −0.049*** |
| | | | | (1.531) | (0.823) | (0.457) | | | | (0.474) | (0.296) | (0.661) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | −0.326 | −1.722 | 0.716 | | | | −0.484** | −1.069*** | −2.699*** |
| | | | | (1.905) | (1.026) | (0.256) | | | | (0.504) | (0.315) | (0.297) |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Year-fixed effects | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Industry-fixed effects | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observation | 1032 | 1032 | 1032 | 1032 | 1032 | 1032 | 6036 | 6036 | 6036 | 6036 | 6036 | 6036 |
| R-Squared | 0.0473 | 0.2292 | 0.0501 | 0.0628 | 0.2658 | 0.0867 | 0.0473 | 0.2205 | 0.0456 | 0.0573 | 0.2488 | 0.0850 |

**Table 12**
GMM estimation of dividend payouts of greenness and green investment
Table 12 reports the GMM estimation of greenness and green investment on dividend announcement dates. All variables are defined in Table 1. All regressions include year and industry fixed effects. We cluster standard errors at firm dimensions. The results are reported at ***1% significance; **5% significance; *10% significance level. The sample period is 2013–2022.

| Variables | (4) | (5) | (6) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Div_dum | DPS | Payout_ratio | Div_dum | DPS | Payout_ratio |
| $Greenness_{i,t}$ | −0.095*** | −0.217*** | −1.007*** | −2.681*** | −0.164** | −0.299*** |
| | (0.060) | (0.037) | (0.722) | (0.531) | (0.308) | (0.323) |
| $Green\_invesment_{i,t}$ | 0.064*** | 0.013*** | 0.889*** | 0.169*** | 0.177*** | 0.058*** |
| | (0.018) | (0.013) | (0.243) | (0.160) | (0.125) | (0.126) |
| $Ind/Board_{i,t}$ | | | | −0.269*** | −0.188*** | −1.671*** |
| | | | | (0.037) | (0.022) | (0.433) |
| $\ln(Board)_{i,t}$ | | | | −0.092*** | −0.092*** | −4.317*** |
| | | | | (0.029) | (0.017) | (0.347) |
| $Greenness_{i,t}*Green\_invesment_{i,t}$ | −0.141*** | −0.096*** | −1.773*** | −2.334*** | −2.526*** | −0.077** |
| | (0.099) | (0.074) | (1.426) | (0.868) | (0.715) | (0.976) |
| $Greenness_{i,t}*Ind/Board_{i,t}$ | | | | −1.213*** | −0.375** | −0.689*** |
| | | | | (0.239) | (0.150 | (0.933) |
| $Greenness_{i,t}*\ln(Board)_{i,t}$ | | | | −0.811*** | −0.127*** | −0.603*** |
| | | | | (0.200) | (0.119) | (0.247) |
| $Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | 0.022 | 0.039 | 3.922*** |
| | | | | (0.056) | (0.039) | (0.747) |
| $Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | 0.097 | 0.073 | 1.275 |
| | | | | (0.068) | (0.050) | (0.864) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*Ind/Board_{i,t}$ | | | | −0.227*** | −0.129*** | −5.585*** |
| | | | | (0.311) | (0.233) | (0.393) |
| $Greenness_{i,t}*Green\_invesment_{i,t}*\ln(Board)_{i,t}$ | | | | −0.954*** | −1.044*** | −0.116*** |
| | | | | (0.369) | (0.283) | (0.845) |
| Controls | YES | YES | YES | YES | YES | YES |
| Year-fixed effects | YES | YES | YES | YES | YES | YES |
| Industry-fixed effects | YES | YES | YES | YES | YES | YES |
| Observation | 7068 | 7068 | 7068 | 7068 | 7068 | 7068 |

Arellano and Bover (1995), Blundell and Bond (2000), and Hasan et al. (2022). Given the documented greater efficiency of the System GMM approach, as demonstrated by Blundell and Bond (1998), and the weakness of instruments associated with the Difference GMM approach, as noted by Alonso-Borrego and Arellano (1999), we opted for the former in this study. Furthermore, we selected a two-step estimation strategy over a one-step approach, as it has been shown to be more effective, as indicated by Alam et al. (2020)

Asongu et al. (2018) emphasize that when working with panel data characterized by a limited time dimension (T = 10) relative to its cross-sectional dimension (N = 7068), System GMM appears to be a suitable choice. This approach aligns well with the structure of panel data, making it suitable for addressing various issues, including endogeneity, unobserved heterogeneity, measurement errors, and omitted variable bias that may arise from reverse causality.

Given that dividends can influence a company's profitability, and earnings can also impact dividend payments, the issue of reverse causality is a concern. An example of reverse causality, often referred to as simultaneity bias, is when a higher corporate valuation prompts managers to initiate dividends payments. To mitigate this potential simultaneity bias, we relied on System GMM estimation, which Frijns et al. (2014) assert helps to circumvent such issues and produces more accurate findings compared to ordinary least squares (OLS) regressions.

Table 12 provides evidence that our first two independent variables, Greenness and Green Investment, exhibit statistical significance at the 0.01 level in all six Columns. Furthermore, the signs of these coefficients remain consistent across all Columns. Even when Greenness and Green Investment are interacted with each other, their coefficient values remain statistically significant at the 0.01 level and consistently display negative signs across all six Columns. However, our third independent variable, Gov($i,t$), does not achieve statistical significance in Columns (4) through (6). These results align with our previous findings and support our hypotheses.

## 5. Conclusion

In the context of impression management and corporate strategies, our research investigates an area that has been relatively unexplored. While it is well-established that businesses employ various tactics to shape stakeholders' perceptions, our focus narrows down to a specific challenge, one that does not necessarily originate directly from a company's operations but is intricately tied to its local environment. This aspect is of key importance, given the existing research emphasizing how a region's reputation significantly impacts the businesses headquartered therein.

Our contribution to the literature on impression management is based on our investigation into the intricate interplay between a company's local CO2 emissions, its investments in sustainability (commonly referred to as green investments), and its dividend policy. This is particularly relevant in the contemporary landscape, where environmental, social, and governance (ESG) concerns are mounting. We have chosen to employ regional CO2 emissions as a proxy for the environmental reputation of the area, and the percentage of annual turnover invested in resource efficiency as a measure of green investments.

Our findings are of importance. They reveal that firms situated in environmentally compromised regions are more inclined to adopt dividend strategies as a means of offsetting the negative perceptions associated with their geographical locations. This tendency extends to both the probability of dividend payments and the magnitude of such payments. Importantly, these results are robust even after accounting for a multitude of factors, including firm-related factors, governance dynamics, year- and industry-specific effects, and other variables.

Interestingly, our research also uncovers a contrasting trend. Companies that invest more in green initiatives seem reticent to increase their dividend payments; in fact, they are more inclined to reduce them. This highlights a tension between environmental responsibility and shareholder value distribution, a tension requiring further exploration.

Our findings remain robust across different subsamples, including periods before and during the COVID-19 pandemic, as well as when considering factors such as growth potential and agency problems. Moreover, our use of GMM estimation reinforces two relationships: a negative relationship between geographic greenness and dividend payouts, and a positive one between green investments and dividend payouts. Notably, these relationships are stronger among firms in heavily polluted areas and those that emphasize green investments, suggesting a clear interplay between environmental consciousness and financial policies.

In a broader context, our research shows the role of dividend payments in mitigating agency costs. It suggests that dividend policies, particularly those influenced by stakeholders' environmental concerns, hold the potential to yield positive outcomes for all stakeholders. This aligns with the principles of sustainable corporate finance, where wealth creation and value maximization extend beyond shareholders to encompass a broader ethical and inclusive perspective.

While our findings offer valuable insights, they also raise several critical questions. How do firms strike a balance between environmental responsibility and shareholder interests? What are the long-term implications of prioritizing one over the other? Further research in this domain is essential to shed light on these complex dynamics and inform corporate strategies in an increasingly ESG-focused world.

## CRediT authorship contribution statement

**Fakhrul Hasan:** Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Basil Al-Najjar:** Writing – review & editing, Writing – original draft, Supervision, Funding acquisition.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

Data will be made available on request.

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